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09/998,284	11/30/2001	Charlotte Horsmans Poulsen	674523-2012	5487

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EXAMINER
NASHED, NASHAAT T

ART UNIT	PAPER NUMBER
1652	

DATE MAILED: 11/25/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/998,284	Applicant(s) Poulsen et al.
	Examiner Nashaat T. Nashed	Art Unit 1652

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *three* MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) ☒ Responsive to communication(s) filed on *Nov 30, 2001*.

2a) ☐ This action is **FINAL.** 2b) ☒ This action is non-final.

3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) ☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above, claim(s) _____ is/are withdrawn from consideration.

5) ☐ Claim(s) _____ is/are allowed.

6) ☒ Claim(s) *1-29* is/are rejected.

7) ☐ Claim(s) _____ is/are objected to.

8) ☐ Claims _____ are subject to restriction and/or election requirement.

Application Papers

9) ☐ The specification is objected to by the Examiner.

10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) ☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) ☒ All b) ☐ Some* c) ☐ None of:

1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

a) ☐ The translation of the foreign language provisional application has been received.

15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s). *3*
4) ☐ Interview Summary (PTO-413) Paper No(s). _____
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

Claims 1-29 are pending and under consideration in this Office action.

The following guidelines illustrate the preferred layout and content for patent applications. These guidelines are suggested for the applicant's use.

Arrangement of the Specification

The following order or arrangement is preferred in framing the specification and, except for the reference to the drawings, each of the lettered items should appear in upper case, without underling or bold type, as section headings. If no text follows the section heading, the phrase "Not Applicable" should follow the section heading:

(a) Title of the Invention.
(b) Cross-Reference to Related Applications.
(c) Statement Regarding Federally Sponsored Research or Development.
(d) Reference to a "Sequence Listing," a table, or a computer program listing appendix submitted on compact disc (see 37 CFR 1.52(e)(5)).
(e) Background of the Invention.
    1. Field of the Invention.
    2. Description of the Related Art including information disclosed under 37 CFR 1.97 and 1.98.
(f) Brief Summary of the Invention.
(g) Brief Description of the Several Views of the Drawing(s).
(h) Detailed Description of the Invention.
(i) Claim or Claims (commencing on a separate sheet).
(j) Abstract of the Disclosure (commencing on a separate sheet).
(k) Drawings.
(l) Sequence Listing, if on paper (see 37 CFR 1.821-1.825).

The specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim 5 is objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 1 from which claims 4 and 5 are dependent limit the composition to an enzyme “obtained or obtainable” from a marine organism, i. e., an enzyme in its native state. The phrase “or a variant, homologue, derivative or fragment thereof” in claim 5 expand the scope of claims 4 and 5 to include

mutants and other carbohydrate oxidizing enzyme from any biological source as well as chemically modified enzymes.

Applicant is advised that should claim 22 be found allowable, claim 24 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

Applicant is advised that should claim 26 be found allowable, claim 28 will be objected to under 37 CFR 1.75 as being a substantial duplicate thereof. When two claims in an application are duplicates or else are so close in content that they both cover the same thing, despite a slight difference in wording, it is proper after allowing one claim to object to the other as being a substantial duplicate of the allowed claim. See MPEP § 706.03(k).

The following is a quotation of the first paragraph of 35 U.S.C. § 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-16, 21, 23, 25, and 27 are rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

The claims are directed to an anti-fouling composition comprising any enzyme "obtained or obtainable" from any marine organism, i. e., any organism that lives in water, and a substrate or a substrate source where in the substrate source is converted to a substrate, presumably, by the action of a second enzyme. The specification, however, only provides a single representative species from these enzymes, i. e., hexose oxidase from *Chondrus cripus*. There is no disclosure of any particular structure to function/activity relationship in the single disclosed species. The specification also fails to describe additional representative species of these enzymes by any identifying structural characteristics or properties other than the activities recited in claim 4, for which no predictability of structure is apparent. Given this lack of additional representative species as encompassed by the claims, Applicants have failed to sufficiently describe the claimed

invention, in such full, clear, concise, and exact terms that a skilled artisan would recognize Applicants were in possession of the claimed invention.

Claims 1-16, 21, 23, 25, and 27 are rejected under 35 U.S.C. § 112, first paragraph, as the disclosure is enabling only for claims limited to an anti-fouling composition comprising *Chondrus cripus* hexose oxidase of SEQ ID NO: 2, and any of its known substrate listed in the specification. The specification does not enable any person skilled in the art to make and use the invention commensurate in scope with these claims. The claims are broader than the enablement provided by the disclosure with regard to all possible enzymes "obtained or obtainable" from a marine organisms and their substrates the huge number of all possible. In addition, claim 5, expand the embodiment of claim 4 to include insertion, deletion, substitution and combination thereof mutants, homologue and fragments of SEQ ID NO: 2 which have any oxidase activity. Factors to be considered in determining whether undue experimentation is required, are summarized *In re* Wands [858 F.2d 731, 8 USPQ 2nd 1400 (Fed. Cir. 1988)]. The Wands factors are: (a) the quantity of experimentation necessary, (b) the amount of direction or guidance presented, (c) the presence or absence of working example, (d) the nature of the invention, (e) the state of the prior art, (f) the relative skill of those in the art, (g) the predictability or unpredictability of the art, and (h) the breadth of the claim.

The nature and breadth of the claimed invention encompasses any anti-fouling composition comprising any enzyme "obtained or obtainable" from any marine organism and its substrate. In addition, claim 5, expand the embodiment of claim 4 to include insertion, deletion, substitution and combination thereof mutants, homologue and fragments of SEQ ID NO: 2 which have any oxidase activity. The specification provides guidance and examples in the form of an assay to obtain the hexose oxidase of SEQ ID NO: 2 from *Chondrus cripus*, formulating the enzyme and its substrate into an anti-fouling composition, and provide experimental evidence that the composition produces the desired results (see examples 1-9). While protein purification methods and molecular biological techniques as well as genetic manipulation to purify and make any enzyme from any biological source are known in the prior art and the skill of the artisan are well developed, knowledge regarding the desired enzymatic activities, their biological source, and a method of redisgning the polypeptide of SEQ ID NO: 2 by insertion, deletion, substitution and combination thereof of more than one amino acid residue is lacking. Thus, searching for an enzymatic activity that has the desired properties to be incorporated into an anti-fouling composition is well outside the realm of routine experimentation and predictability in the art of success is extremely low. Applicants should be reminded that the sugar substrates and their precursor such as starch and cellulose used in the examples are common plant products, and relatively inexpensive to be incorporated into a paint composition and the like. Many other substrates may not have the same availability or cheap enough to be used in a paint composition. The amount of experimentation to

identify a suitable enzyme and its substrate or variant, homologue, derivative, or fragment of SEQ ID NO: 2 is enormous. Since routine experimentation in the art does not include screening vast numbers of marine organisms for a desired enzymatic activity, develop a purification method for said enzyme, clone the gene encoding the enzyme, develop a recombinant method to make the enzyme, identify suitable variant or homologue of the polypeptide of SEQ ID NO: 2, and formulate the enzyme and its substrate into an anti-fouling composition with the desired propertied where the expectation of obtaining desired composition is unpredictable, the Examiner finds that one skilled in the art would require additional guidance, such as information regarding the enzymatic activity to be used, the biological source, the gene encoding said enzymatic activity, the suitable variant and homologue of SEQ ID NO: 2 and their man-made or natural source, and the substrate for the enzymatic activity and its source. Without such a guidance, the experimentation left to those skilled in the art is undue.

Claims 1-29 are rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The following are the reasons for the rejections:

(a) The phrase "precursor enzyme" in claims 1, 8, 9, and 16 renders the claims indefinite because the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. The phrase "precursor enzyme" is known to refer to an enzyme precursor such as zymogen or enzyme containing a pre- and/or propeptide. Enzyme precursor are generally inactive or have very low catalytic activity. For examination purposes, the phrase is assumed to mean "an enzyme" that acts on the precursor substrate to generate a substrate for the enzyme of (ii). To avoid confusing the two enzyme in (ii) and (iii)(b) in the claim, the two enzymes should be distinguished from one another.

(b) The phrase "obtained or obtainable" in claims 1-3, 16, and 21-28 renders the claims indefinite because the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. For examination purposes only, the phrase is assumed to mean "known or unknown".

(c) The phrase "or a variant, homologue, derivative or fragment thereof" in claim 5 renders the claims indefinite because the resulting claim does not clearly set forth the metes and bounds of the patent protection desired. For examination purposes the phrase is taken to mean any carbohydrate oxidase from any biological source, its mutants, fragments.

(d) Claims 17-20 are indefinite in that they fail to point out what is included or excluded by the claim language. These claims are an omnibus type claim. These claims are not treated any further on their merit because the examiner could not assume any reasonable embodiments in the claims.

(e) Claims 4, 7, 10-15, and 29 are included with these rejections because they are dependent on rejected claims and do not cure their deficiencies.

The following is a quotation of 35 U.S.C. § 103 which forms the basis for all obviousness rejections set forth in this Office action:

> A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.
>
> Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. § 103, the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 C.F.R. § 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of potential 35 U.S.C. § 102(f) or (g) prior art under 35 U.S.C. § 103.

Claims 1-16 and 21-29 are rejected under 35 U.S.C. § 103 as being unpatentable over (IDS: reference AF, EP-0866103 A1) in view of Hansen *et al.* [J. Biol. Chem. 272 (17), April 25, 1997, pages 11581-11587].

Hamade *et al.* teach a method preventing fouling surfaces submerged in water by in which an anti-fouling agent is produced by an enzyme action on its substrate, and anti-fouling composition comprising an enzyme and its substrate, see abstract. They specifically teach an enzyme substrate combination capable of producing hydrogen peroxide and exemplify the enzyme-substrate combination with glucose oxidase-glucose and hexose oxidase-glucose, see page 5, lines 14-22. In addition, they teach that the substrate of said oxidase can be produced within the composition by a second enzyme action on a precursor substrate such as the action of cellulase on cellulose to produce

glucose, see page 5, lines 50-54. Thus, Hamade *et al.* teach the claimed composition and method except that they did not teach the enzyme from a marine organism.

Hansen *et al.* teach the hexose oxidase from *Chondrus crispus* which catalyzes the oxidation of a variety of mono- and disaccharides including glucose, galactose, maltose, cellobiose and lactose, see abstract, the first paragraph following the abstract, and Table III, on page 11586. Also, they teach that the use of functionally related enzyme glucose oxidase in the production of hydrogen peroxide among other uses, and suggested that the hexose oxidase from *C. crispus* would be a superior substitute for glucose oxidase because of its broader substrate specificity. In addition, they teach the cloning and expression of said hexose oxidase, and report the amino acid sequence and nucleic acid encoding said amino acid sequence, see Figure 3 on page 11585. The amino acid sequence reported in Figure 3 is identical to that of SEQ ID NO: 2 of the instant application.

Hamade *et al.* teach an anti-fouling composition comprising glucose or hexose oxidase. Hansen *et al.* provide one of ordinary skill in the art at the time of invention to use the hexose oxidase from *C. crispus* as they teach that hexose oxidase is a superior substitute to glucose oxidase for all of its uses because of its broader substrate specificity. Thus, it would have been obvious at the time of invention to one of ordinary skill in the art to formulate and anti-fouling composition as taught by Hamade *et al.* comprising the hexose oxidase from *C. crispus*, a marine organism, taught by Hansen *et al.* and use said composition to treat surfaces such as outdoor wood work and the hull of marine vessels (claims 1-8, 10-16, and 21-29). Although Hamade *et al.* do not teach specifically the use of amyloglucosidase to act on the precursor substrate to produce the substrate for the hexose oxidase, they teach any enzyme/substrate combinations that lead to the formation of any substrate for the hexose oxidase would be a good combination, see page 5, lines 50-53. Since the action of amyloglucosidase on its substrate is known to produce glucose, it would have been obvious to one of ordinary skill in the art to use amyloglucosidase to act on the precursor substrate (claim 9). Thus, the claimed invention was within the ordinary skill in the art to make and use at the time was made and was as a whole, clearly *prima facie* obvious.

Claims 1-16, 21, 23, 25, and 27 are rejected under 35 U.S.C. § 103 as being unpatentable over Hamade *et al.* (IDS: reference AF, EP-0866103 A1) in view of U. S. P. 6,251,626 B1 [626 patent, Stougaard *et al.*].

The teachings of Hamade *et al.* are summarized above.

The 626 patent teaches the purification and cloning of hexose oxidase from *Chondrus crispus* which catalyzes the oxidation of a variety of mono- and disaccharides

including glucose, galactose, maltose, cellobiose and lactose, see abstract, the first paragraph following the abstract, and Technical background, column 1 and 2. Also, they teach that the use of functionally related enzyme glucose oxidase in the production of hydrogen peroxide among other uses, and suggested that the hexose oxidase from *C. crispus* would be a superior substitute for glucose oxidase because of its broader substrate specificity, see column 1. In addition, they teach the expression of said hexose oxidase, and report the amino acid sequence and nucleic acid encoding said amino acid sequence, SEQ ID NO's: 31 and 30, respectively. The amino acid sequence of SEQ ID NO: 31 of the 626 patent differes only in one amino acid residue from that of SEQ ID NO: 2 of the instant application.

Hamade *et al.* teach an anti-fouling composition comprising glucose or hexose oxidase. The 626 patent provides one of ordinary skill in the art at the time of invention to use the hexose oxidase from *C. crispus* as they teach that hexose oxidase is a superior substitute to glucose oxidase for all of its uses because of its broader substrate specificity. Thus, it would have been obvious at the time of invention to one of ordinary skill in the art to formulate and anti-fouling composition as taught by Hamade *et al.* comprising the hexose oxidase from *C. crispus*, a marine organism, taught in the 626 patent and use said composition to treat surfaces such as outdoor wood work and the hull of marine vessels (claims 1-8, 10-16, 21, 23, 25, and 27). Although Hamade *et al.* do not teach specifically the use of amyloglucosidase to act on the precursor substrate to produce the substrate for the hexose oxidase, they teach any enzyme/substrate combinations that lead to the formation of any substrate for the hexose oxidase would be a good combination, see page 5, lines 50-53. Since the action of amyloglucosidase on its substrate is known to produce glucose, it would have been obvious to one of ordinary skill in the art to use amyloglucosidase to act on the precursor substrate (claim 9). Thus, the claimed invention was within the ordinary skill in the art to make and use at the time was made and was as a whole, clearly *prima facie* obvious.

No claim is allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Nashaat T. Nashed, Ph. D. whose telephone number is (703) 305-6586. The examiner can normally be reached Monday, Tuesday, Thursday, and Friday from 9:00 a.m. to 5:30 p.m.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ponnathapura Achutamurthy, can be reached on (703) 308-3804. The fax phone numbers for this Group are (703) 305-3014 and (703)308-4242.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0196.

Nashaat T. Nashed, Ph. D.
Primary Examiner